

### 3. FISHING GEAR AND PRACTICES USED IN THE NORTHEAST REGION

The geographical area of responsibility of the Northeast Region also falls variously within the jurisdiction of the New England Fishery Management Council (NEFMC) and Mid-Atlantic Fishery Management Council (MAFMC), as well as the individual states from Maine to North Carolina which are represented by the Atlantic States Marine Fisheries Commission (ASMFC). These organizations are responsible for the management of many different fisheries, extending from the upper reaches of rivers and estuaries to the outer limit of the Exclusive Economic Zone, located 200 mi offshore, well beyond the edge of the continental shelf (Figure 2.1). In addition, some federally managed species that are found at certain times of year in the Northeast Region are managed by the South Atlantic Fisheries Management Council.

Fishing gear types used to land 1% or more of any species managed by either the NEFMC or MAFMC are listed in Table 3.1, and gear types that contributed 1% or more of any individual state's total landings for federally and state-managed species are listed in Table 3.2. Although certain gear types used in state waters are not managed by the federal government, they may adversely impact EFH that is designated in nearshore, estuarine, and riverine areas. Consequently, Table 3.3 lists all fishing gear types and harvesting techniques that are identified in Tables 3.1 and 3.2, and indicates whether they are used in estuaries, coastal waters (0-3 mi), or offshore waters (3-200 mi). Since the seafloor is the location of the habitat types most susceptible to gear disturbances, Table 3.3 also indicates which gear types and harvesting techniques contact the bottom, and which ones are regulated under a federal fishery management plan (FMP). This document considers a gear to be regulated under a federal FMP if it is typically utilized to harvest fish under a federal vessel or operators permit. Most of the gear types listed in Table 3.3 are described in this chapter of the document.

Unless otherwise noted by reference in the following descriptions, the information used to describe gear types and fishing practices in the Northeast Region was obtained from four primary sources: Sainsbury (1996), DeAlteris (1998), Everhart and Youngs (1981), and the report of a panel of science and fishing industry representatives on the effects of fishing gear on marine habitats in the region (NREFHSC 2002). Information regarding the use of fishing gears in state waters within the region was extracted from Stephan *et al.* (2000). The gear descriptions in this document are based on information that was available to the authors and, in some cases, are incomplete.

#### BOTTOM-TENDING MOBILE GEAR

##### Bottom Trawls

Trawls are classified by their function, bag construction, or method of maintaining the mouth opening. Function, in turn, may be defined by the part of the water column where the trawl operates (*e.g.*, bottom) or by the species that it targets (Hayes 1983). Bottom trawls are designed to be towed along the seafloor and to catch a variety of demersal fish and invertebrate species. Mid-water trawls are designed to catch pelagic species in the water column, and do not normally contact the bottom. They are described under "Pelagic Gear" later in this chapter. Three general types of bottom trawl, are used in the Northeast Region, but one of them, the bottom otter trawl, accounts for nearly all commercial bottom trawling activity.

##### Otter Trawls

There is a wide range of otter trawl types used in the Northeast Region because of the diversity of fisheries prosecuted and bottom types encountered in the region. The specific gear design is often a result of the target species (*e.g.*, whether they are found on or off the bottom) as well as the composition of the bottom (*i.e.*, smooth versus rough and soft versus hard). Bottom otter trawls are used to catch a variety of species throughout the region and account for a higher proportion of the catch of federally managed species than any other gear type in the region (Tables 3.1 and 3.2).

There are three components of the otter trawl that come in contact with the seafloor: the doors, the ground cables and bridles which attach the doors to the wings of the net, and the sweep which runs along the bottom of the net mouth. The footrope of the net is attached to the sweep. Bottom trawls are towed at a variety of speeds, but average about 5.6 km/hr (3 knots).

Use of this gear in the region is managed under several federal FMPs. Bottom trawling is also subject to a variety of state regulations throughout the region.

##### Doors

The traditional otter board or door is a flat, rectangular wood structure with steel fittings and a steel "shoe" along

the leading and bottom edges that prevents damage and wear of the door as it drags over the bottom. Wooden trawl doors are still in use in the Northeast Region, but they have been largely replaced by heavier, more efficient, steel doors. Two types of steel doors commonly used in the region are the V-shaped “Thyboron” door and the cambered (or curved) “Bison” door (pers. comm.; Alan Blott, National Marine Fisheries Service, North Kingstown, RI). Either type of door can be slotted to allow some water to flow through the door, further increasing its efficiency. Steel “shoes” can be added at the bottom of the door to aid in keeping it upright and take the wear from bottom contact. The sizes and weights of trawl doors used in the Northeast Region vary according to the size and type of trawl, and the size and horsepower of the vessel. Large steel doors (4–5 m<sup>2</sup>) weigh between 700 kg and 1 mt.

It is the location on each door at which the towing cable, or “warp,” is attached that creates the towing angle, which in turn creates the hydrodynamic forces needed to push the door outward and downward, thus spreading the wings of the net. The nontraditional designs increase the spreading force of the door by increasing direct pressure on the face of the door and/or by creating more suction on the back of the door. On fine-grained sediments, the doors also function to create a silt cloud that aids in herding fish into the mouth of the net. On rocky or more irregular bottom, trawl doors impact rocks in a jarring manner and can jump distances of 1–2 m (Carr and Milliken 1998).

### **Ground Cables and Bridles**

Steel cables are used to attach the doors to the wings of the net. A ground cable runs along the bottom from each door to two other cables (*i.e.*, the upper and lower “bridles”) that diverge to attach to the top and bottom of the net wing. The lower bridle also contacts the bottom. In New England, fixed rubber disks (“cookies”) or rollers are attached to the ground cables and lower bridles to assist the passage of the trawl over the bottom. For bottom trawling, in very general terms, bridles vary in length from 9 to 73 m (30 to 240 ft), while ground cables vary from 0 to 73 m (0 to 240 ft), depending upon bottom conditions, towing speed, and fish behavior.

### **Sweeps**

Two types of sweep are used on smooth bottom in New England (Mirarchi 1998). In the traditional chain sweep, loops of chain are suspended from a steel cable, with only 2–3 links of the chain touching bottom. Contact of the chain with the bottom reduces the buoyancy of the trawl so that it skims just a few inches above the bottom to catch species such as squid and scup that swim slightly

above the bottom. The other type of New England smooth-bottom sweep is used to catch flounder. Instead of a cable, it uses a heavy chain with rubber cookies stamped from automobile tires. This latter type of sweep is always in contact with the bottom. The cookies vary in diameter from 10 to 41 cm (4 to 16 in) and do not rotate (Carr and Milliken 1998).

On rough bottoms, roller and rockhopper sweeps are used (Carr and Milliken 1998). In the roller sweeps, vertical rubber rollers as large as 91 cm (36 in) in diameter are placed at intervals along the sweep. In fact, however, only the “rollers” that are located at or near the center of the sweep actually “roll” over the bottom; because the sweep is shaped in a curve, the others are oriented at increasing angles to the direction of the tow and do not rotate freely as they are dragged over the bottom (pers. comm.; Alan Blott, National Marine Fisheries Service, North Kingstown, RI). In New England, roller sweeps have been largely replaced with “rockhopper” sweeps that use larger fixed rollers, and are designed to “hop” over rocks as large as 1 m in diameter. Small rubber “spacer” disks are placed between the larger rubber disks in both types of sweep. Rockhopper gear is no longer used exclusively on hard-bottom habitats, but is actually quite versatile and is used in a variety of habitat types (Carr and Milliken 1998). The range of footrope/headrope lengths for bottom trawls used in the New England inshore day-boat fleet is 18/12 m (60/40 ft) for smaller (12-m or 40-ft) vessels, and increases up to 42/36 m (140/120 ft) for larger vessels (21 m/70 ft or larger) (pers. comm.; Alan Blott, National Marine Fisheries Service, North Kingstown, RI).

### **Factors Affecting Area Swept by Bottom Otter Trawls**

The area of bottom that is contacted by a bottom otter trawl during a tow is a function of the linear distance covered (a product of the speed of the net over the bottom and the duration of the tow) and the width of the tow path. The width of the tow path is the distance between the doors (*i.e.*, across the mouth of the net) and varies according to the force exerted on the doors, the ground cables, the sweep, and the net as it is towed over the bottom. Nets towed at higher speeds, or that offer more resistance to being towed through the water and over the bottom, are swept back in a more pronounced parabolic shape than nets towed at slower speeds, or nets that offer less resistance. Mirarchi (1998) has estimated that on smooth bottom and at a towing speed of 5.6 km/hr (3 knots), the linear distance between the doors is equal to roughly one-third of the total length of the ground cables, the bridles, and the sweep. Thus, a bottom trawl with a 30-m (100-ft) sweep and 75-m (250-ft) bridles and ground cables on either side of the net would sweep an area 60 m (200 ft) wide.

### ***Some Specific Types of Otter Trawl Used in the Region***

A number of different types of bottom otter trawl used in the Northeast Region are specifically designed to catch certain species of fish, on specific bottom types, and at particular times of year. Some of the major differences in bottom trawl design are described here, but these descriptions are not very specific because there are many variations of each basic trawl type, and because detailed information on all the different types of bottom trawl used in the region are lacking. Furthermore, the performance of any bottom trawl (*i.e.*, how it “behaves” as it is towed over the bottom), and the degree to which it contacts and disturbs the bottom during any tow, are affected by a number of factors such as how much trawl wire is set out (relative to the depth), the bottom type and topography, the amount of bottom current, etc.

Flatfish trawls, described by Mirarchi (1998), are designed with a low net opening between the headrope and the footrope and more ground rigging (*i.e.*, rubber cookies and chain) on the sweep. This type of trawl is designed so that the sweep will follow the contours in the bottom, and to get fish like flounders -- that lie in contact with the seafloor -- up off the bottom and into the net. It is used on smooth mud and sand bottoms. A high-rise or fly net with larger mesh has a wide net opening and is used to catch demersal fish that rise higher off the bottom than flatfish (NREFHSC2002).

Bottom otter trawls used to catch species like scup and squid that swim over the bottom are rigged very lightly, with loops of chain suspended from the sweep (Mirarchi 1998). This gear is designed to skim along the seafloor with only two or three links of each loop of chain touching the bottom (details are described above). This type of trawl is also used on smooth bottoms.

Bottom otter trawls that are used on “hard” bottom (*i.e.*, gravel or rocky bottom), or mud or sand bottom with occasional boulders, are rigged with rockhopper gear. The purpose of the “ground gear” in this case is to get the sweep over irregularities in the bottom without damaging the net. The purpose of the sweep in trawls rigged for fishing on smooth bottoms is to herd fish into the path of the net (Mirarchi 1998).

Small-mesh trawls are used in the Northeast Region to capture northern and southern shrimp, silver hake (whiting), butterfish, and squid. Bottom trawls used to catch northern shrimp in the GOM are smaller than most fish trawls. Footropes range in length from 12 m to over 30 m (40-100 ft), but most are 15-27 m (50-90 ft). Regulations require that northern shrimp trawls may not be used with ground cables, and that the “legs” of the bridles not exceed 27 m (90 ft). These regulations were implemented in order to reduce the amount of area swept during a tow, thus reducing the bycatch of groundfish species. Northern shrimp trawls are also required to have Nordmore grates in

the funnel of the net which reduce the retention of groundfish that enter the net. There has been a trend in recent years towards the use of heavier, larger roller and/or rockhopper gear in this fishery (ASMFC 2004).

The raised-footrope trawl was designed especially for fishing for silver hake, red hake, and dogfish. It was designed to provide vessels with a means of continuing to fish for small mesh species without catching groundfish. Raised-footrope trawls can be rigged with or without a chain sweep. If no sweep is used, drop chains must be hung at defined intervals along the footrope. In trawls with a sweep, chains connect the sweep to the footrope. Both configurations are designed to make the trawl fish about 0.45-0.6 m (1.5-2 ft) above the bottom (Carr and Milliken 1998). Although the doors of the trawl still ride on the bottom, underwater video and observations in flume tanks have confirmed that the sweep in the raised-footrope trawl has much less contact with the seafloor than does the traditional cookie sweep that it replaces (Carr and Milliken 1998).

An important consideration in understanding the relative effects of different otter trawl configurations is their weight in water relative to their weight in air. Rockhopper gear is not the heaviest type of ground gear used in this region since it loses 80% of its weight in water (*i.e.*, a rockhopper sweep that weighs 1000 lb on land may only weigh 200 lb in water). Plastic-based gear has the smallest weight-in-water to weight-in-air ratio (approximately 5%). For the same reasons, steel doors are much heavier in water than wooden doors.

### **Pair Trawls**

Bottom pair trawls are towed over the bottom by two vessels, each towing one warp of the net. The mouth of the net is kept open by the outward pull provided by the two boats, so that no otter boards are required. By utilizing the combined towing power of the two vessels, and as no otter boards are needed, a larger net may be worked than would be possible by a single vessel. Alternatively, two vessels of low horsepower can combine to use this method efficiently. Bottom pair trawls are effective at catching demersal species such as cod and flatfish as well as small pelagic species.

This gear is rigged more simply than an otter trawl, with the warps being connected directly to the bridles from each wing of the net. Normally, a greater warp length/water depth ratio than for otter trawling is required because there are no doors to increase the drag of the gear in the water. The additional “scope” allows the warps to tend the bottom for some distance ahead of the bridles, creating a mud cloud that herds fish into the opening of the net. In some operations, ground cables may be rigged ahead of the bridles with weights placed at the connection to the warps.

Pair trawling for groundfish species managed by the NEFMC is currently prohibited.

## Danish and Scottish Seines

Danish or long seining, or “anchor dragging,” was developed in the 1850s prior to the advent of otter trawling. The Danish seine is a bag net with long wings that includes long warps set out on the seafloor enclosing a defined area. As the warps are retrieved, the enclosed triangular area reduces in size. The warps dragging along the bottom herd the fish into a smaller area, and eventually into the net mouth. The gear is deployed by setting out one warp, then the net, and finally the other warp. On retrieval of the gear, the vessel is anchored. This technique of fishing is aimed at specific schools of fish located on smooth bottom.

In contrast to Danish seining, if the vessel tows ahead while retrieving the gear, then this is referred to as Scottish seining or “fly-dragging.” This method of fishing is considered more appropriate for working small areas of smooth bottom, surrounded by rough bottom.

Scottish and Danish seines have been used experimentally in U.S. demersal fisheries. Space conflicts with other mobile and fixed gears have precluded the further development of this gear in the United States, as compared to northern Europe.

This activity is managed under federal FMPs.

## Hydraulic Clam Dredges

### *Atlantic Surfclam and Ocean Quahog Fishery*

Hydraulic clam dredges have been used in the Atlantic surfclam fishery for over five decades, and in the ocean quahog fishery since its inception in the early 1970s. The typical dredge is 3.7 m (12 ft) wide and about 6.7 m (22 ft) long, and uses pressurized water jets to wash clams out of the seafloor. Towing speed at the start of the tow is about 4.6 km/hr (2.5 knots), and declines as the dredge accumulates clams. The dredge is retrieved once the vessel speed drops below about 2.8 km/hr (1.5 knots), which can be only a few minutes in very dense beds. However, a typical tow lasts about 15 min. The water jets penetrate the sediment in front of the dredge to a depth of about 20-25 cm (8-10 in) and help to “drive” the dredge forward. The water pressure that is required to fluidize the sediment varies from 50 lb/in<sup>2</sup> (psi) in coarse sand to 110 psi in finer sediments. The objective is to use as little pressure as possible since too much pressure will blow sediment into the clams and reduce product quality. The “knife” (or “cutting bar”) on the leading bottom edge of the dredge opening is 14 cm (5.5 in) deep for surfclams and 9 cm (3.5 in) for ocean quahogs. The knife “picks up” clams that have been separated from the sediment and guides them into the body of the dredge (“the cage”).

Hydraulic clam dredges can be operated in areas of large-grain sand, fine sand, sand with small-grain gravel, sand with small amounts of mud, and sand with very small amounts of clay. Most tows are made in large-grain sand.

Surfclam/quahog dredges are not fished in clay, mud, pebbles, rocks, coral, large gravel >0.5 in, or seagrass beds.

Use of this gear in the region is managed under federal FMPs, and is also regulated in state waters in the Mid-Atlantic region, especially in shallow waters where submerged aquatic vegetation grows.

### *Softshell Clam Fishery*

Hydraulic dredges are also used in the softshell (*Mya arenaria*) fishery in state waters of Maryland and Virginia. In this fishery, the dredge manifold and blade are located just forward of an escalator, or conveyor belt, that carries the clams to the deck of the vessel. Escalator dredges are typically operated from 15-m (49-ft) vessels in water depths of 2-6 m (7-20 ft). This gear cannot be operated in water depths less than one-half the length of the escalator.

Use of the escalator dredge is not managed under federal FMPs. This gear is subject to many of the same state laws and regulations that apply to surfclam and ocean quahog dredges in state waters.

## Sea Scallop Dredges

The New Bedford-style scallop dredge is the primary gear used in the Georges Bank and Mid-Atlantic sea scallop fishery, and is very different than dredges utilized in Europe and the Pacific because it has no teeth on its leading edge.

The forward edge of the New Bedford-style dredge includes a cutting bar which rides above the surface of the substrate, creating turbulence that stirs up the substrate and kicks objects (including sea scallops) up from the surface of the substrate into the bag. Shoes on the cutting bar ride along the substrate surface. A sweep chain is attached to each shoe and to the bottom of the ring bag (Smolowitz 1998). The bag, which is made of metal rings with chafing gear on the bottom and of twine mesh on the top, drags on the substrate when fished. Tickler chains run from side to side between the frame and the ring bag, and, in hard-bottom scalloping, a series of rock chains run from front to back to prevent large rocks from getting into the bag. New Bedford-style dredges are typically 4.3 m (14 ft) wide; one or two of them are towed by single vessels at speeds of 4-5 knots (7.4-9.3 km/hr). New Bedford-style dredges used along the Maine coast are smaller. Dredges used on hard bottoms are heavier and stronger than dredges used on sand. Towing times are highly variable, depending on the density of marketable-sized sea scallops at any given location. Tows can be as short as 10 min or as long as 1 hr (pers. comm.; Ron Smolowitz, industry advisor to NEFMC Habitat Committee, Falmouth, MA).

In the Northeast Region, scallop dredges are used in high- and low-energy sand environments, and high-energy gravel environments. Although gravel exists in low-energy

environments of deepwater banks and ridges in the GOM, the fishery is not prosecuted there.

The leading edge of scallop dredges used in Europe, Australia, and New Zealand to catch other species of scallop that “dig” into the bottom have teeth that dig into the substrate. A very limited amount of scallop dredging with toothed dredges takes place along the U.S. and Canadian coast of the GOM. These toothed dredges are used by smaller vessels that are not able to tow a New Bedford-style dredge fast enough (4-5 knots) to effectively catch scallops.

The use of scallop dredges in federal waters of the Northeast Region is managed under federal FMPs.

## Other Nonhydraulic Dredges

### Quahog Dredges

Mahogany quahogs (a colloquial name for ocean quahogs in New England) are harvested in eastern Maine coastal waters using a dredge that is essentially a large metal cage on skis, with 15-cm (6-in) long teeth projecting at an angle off the leading bottom edge (pers. comm.; Pete Thayer, Maine Department of Marine Resources, West Boothbay Harbor, ME). The teeth rake the bottom and lift the quahogs into the cage.

This fishery takes place in small areas of sand and sandy mud found among bedrock outcroppings in depths of 9-76 m (30-250 ft) in state and federal coastal waters north of 43°20' N latitude. These dredges are used on small boats (approximately 9-12 m (30-40 ft) long). Because water pressure is not used to dislodge the clams from the seafloor, all the power required to pull these dredges forward is provided by the boat's engine.

This dredging activity is managed under a federal FMP. Maine state regulations limit the length of the cutter bar to 91 cm (36 in).

### Oyster, Crab, Mussel, and Whelk Dredges

The oyster dredge is a toothed dredge consisting of a steel frame 0.5-2.0 m (2-7 ft) wide, a tow chain or wire attached to the frame, and a bag to collect the catch. The teeth are 5-10 cm (2-4 in) in length. The bag is constructed of rings and chain links on the bottom to reduce the abrasive effects of the seafloor, and of twine or webbing on top. In the Northeast Region, oyster dredges are used in state waters from Connecticut to North Carolina to harvest the eastern oyster (*Crassostrea virginica*).

Blue crabs (*Callinectes sapidus*) are harvested with dredges (or “scrapes”) similar to oyster dredges in state waters in New York, New Jersey, Delaware, Virginia, and North Carolina. Stern-rig dredge boats (approximately 15 m (49 ft) long) tow two dredges in tandem from a single chain

warp. The dredges are equipped with 10-cm (4-in) long teeth that rake the crabs out of the bottom.

Dredges are also used to harvest blue mussels (*Mytilus edulis*) in state waters of Maine and Massachusetts, and to harvest channeled and knobbed whelks (*Busycon canaliculatus* and *B. carica*, respectively) in New York, Delaware, and Virginia.

These dredging activities are not managed under federal FMPs. The design and use of crab and shellfish dredges are subject to various restrictions in state waters.

### Bay Scallop Dredges

The bay scallop (*Argopecten irradians*) dredge may be 1.0-1.5 m (3.3-4.9 ft) wide and about twice as long. The simplest bay scallop dredge can be just a mesh bag attached to a metal frame that is pulled along the bottom. For bay scallops that are located on sand and pebble bottom, a small set of raking teeth is set on a steel frame, and skids are used to align the teeth and the bag. Bay scallop dredges are used in state waters of Massachusetts, Rhode Island, New York, and North Carolina.

This dredging activity is not managed under federal FMPs.

### Sea Urchin Dredges

Similar to a simple bay scallop dredge, the sea urchin dredge is designed to avoid damaging the catch. It has an upturned, sled-like shape at the front that includes several automobile leaf springs tied together with a steel bar. A tow bail is welded to one of the springs and a chain mat is rigged behind the mouth box frame. The frame is fitted with skids or wheels. The springs act as runners, enabling the sled to move over rocks without hanging up. The chain mat scrapes up the urchins. The bag is fitted with a cod-end for ease of emptying. This gear is generally used in depths up to 27.5 m (90 ft). Sea urchin dredges are used in state waters in the GOM to harvest green sea urchins (*Strongylocentrotus drobachiensis*).

This dredging activity is not managed under federal FMPs.

## Seines

### Beach Haul Seines

The beach seine resembles a wall of netting of sufficient depth to fish from the sea surface to the seafloor, with mesh small enough that the fish do not become “gilled.” A floatline runs along the top to provide floatation, and a leadline with a large number of attached weights runs along the bottom to ensure that the net

maintains good contact with the bottom. Tow lines are fitted to both ends.

The use of a beach seine generally starts with the net on the beach. One end is pulled away from the beach, usually with a small skiff or dory, and is taken out and around and finally back to shore. Each end of the net is then pulled in towards the beach, concentrating the fish in the middle of the net. The middle of the net is eventually brought onshore as well, and the fish are removed. This gear is generally used in relatively shallow inshore areas.

This activity is not managed under federal FMPs.

### **Long Haul Seines**

The long haul seine is set and hauled in shallow estuarine and coastal areas by one or two boats. The net is a single wall of small-mesh netting (*i.e.*, <5 cm (2 in) as stretched mesh) that is usually >400 m (1310 ft) long and about 3 m (10 ft) deep. In a single-boat operation, one end of the net is attached to a pole driven into the bottom, and the net is set in a circle. After closing the circle, the net is hauled into the boat, reducing the size of the circle, and concentrating the fish. Finally, the live fish are brailled or dipnetted out of the net. In two-boat operations, the net is set as the boats travel in opposite directions, in a circle, from the same starting point. When the net is all out, the boats turn on the same course and pull the seine for some distance before they come together to close the net.

This activity is not managed under federal FMPs.

### **Stop Seines**

The stop-seine fishery evolved from the traditional weir fishery for Atlantic herring in Maine (see “Trap Nets” later in this chapter) and involves the setting of nets across a cove with a narrow entrance after the herring enter, thus blocking their escape. Once the fish are “shut off,” the fishermen wait until the fish enter a small “pocket” in the net. Once they enter the pocket, they are removed with a small purse seine and transferred to boats called “carriers” which bring the catch ashore (NOAA/NMFS 2005). This gear is not used much any more (ASMFC 1999a).

This activity is not managed under federal FMPs.

## **BOTTOM-TENDING STATIC GEAR**

### **Pots**

Pots are small, portable, rigid traps that fish and invertebrates enter through small openings, with or without enticement by bait, but can only leave with difficulty. They are used to capture lobsters, crabs, black

sea bass, eels, and other bottom-dwelling species seeking food or shelter. Pot fishing can be divided into two general classifications: 1) inshore potting in estuaries, lagoons, inlets, and bays in depths up to about 75 m (250 ft); and 2) offshore potting using larger and heavier vessels and gear in depths up to 730 m (2400 ft) or more.

### **Lobster Pots**

Originally, pots used to harvest American lobster (*Homarus americanus*) were constructed of wooden laths with single, and later, double, funnel entrances made from net twine. Today, almost all of the pots are made from coated wire mesh. They are rectangular and are divided into two sections, the “kitchen” and the “parlor.” The kitchen has an entrance on both sides of the pot and is baited. Lobsters enter either chamber then move to the parlor through a long, sloping tunnel to the parlor. Escape vents are installed in both areas of the pot to minimize the retention of sublegal-sized lobsters. Rock crabs (*Cancer* spp.) are also harvested in lobster pots.

Lobster pots are fished as either a single pot per buoy, two or three pots per buoy, or strung together in “trawls” of up to 100 pots. Single pots are often used in rough, hard-bottom areas where lines connecting pots in a trawl line tend to foul on bottom structure. They are fished in trawls on flatter types of bottom. The area of bottom that comes in contact with a single trap during the setting and hauling process is small, but the cumulative effect of several million pots being set and hauled several times a week may be significant (Smolowitz 1998). The total number of traps used in the lobster fishery increased from just over one million in 1970 to over four million in 1998 (ASMFC 2000). According to NREFHSC (2002), important features of lobster pots and their use are the following:

- About 95% of lobster pots are made of plastic-coated wire.
- Pots in trawls are connected by “mainlines” which either float off the bottom, or, in areas where they are likely to become entangled with marine mammals, sink to the bottom.
- Soak time depends on season and location — usually 1-3 days in inshore waters in warm weather, but up to several weeks in colder waters.
- Offshore pots are larger (>1.2 m (4 ft) long) and heavier [~45 kg (100 lb)] than inshore pots, with an average of about 40 pots per trawl. They are usually deployed for 1 wk at a time.

Although the offshore component of the fishery is regulated under federal rules, American lobster is not managed under a federal FMP.

## Fish Pots

Fish pots used to catch black sea bass, ocean pout, and scup (Table 3.1) are similar in design to lobster pots, and are usually fished singly or in trawls of up to 25 pots and in shallower waters than offshore lobster pots or red deepsea crab pots. Pots may be set and retrieved 3-4 times per day when fishing for scup.

Atlantic hagfish (*Myxine glutinosa*) pots are 55-gal plastic barrels with 3-6 entrance funnels and several rows of approximately 1-cm (3/8-in) escape holes. They are set 45-63 m (150-210 ft) apart to depths of 90-282 m (300-930 ft). Small boats fish 20-40 traps in a string, hauling several times per trip, and larger vessels fish 80-200 traps in a string, hauling 1-2 times per day. Soak time varies from 6 to 24 hr. The captain of a 26-m (85-ft) hagfish boat reported that he sets and hauls 1,000 traps (five sets of 200 traps) on each 5-day trip (NEFSC 2004).

Cylindrical pots are typically used for capturing American eels (*Anguilla rostrata*) in rivers and estuaries; however, half-round and rectangular pots are also used. They are hauled and set in a manner similar to that of lobster pots.

The use of fish pots in the black sea bass, scup, and ocean pout fisheries is managed under federal FMPs. Atlantic hagfish and American eel fishing activities in the region are not managed under federal FMPs.

## Crab Pots

Crab pots are used in inshore coastal and estuarine waters in the Mid-Atlantic states to catch blue crabs (*Callinectes sapidus*). These pots typically consist of wire mesh. A horizontal wire partition divides the pot into an upper and lower chamber. The lower chamber is entered from all four sides through small wire tunnels. The partition bulges upward in a fold about 20 cm (8 in) high for about one-third of its width. In the top of the fold are two small openings that give access to the upper chamber. These crab pots are always fished as singles, and are hauled by hand in small boats, or by a pot hauler in larger boats. They are generally fished after an overnight soak, except early and late in the season. These pots are also effective for American eels. This activity is not managed under a federal FMP.

For red deepsea crabs (*Chaceon quinque-dens*), the traditional-style pots are wood and wire traps that are 1.2 m long, 0.75 m wide, and 0.5 m high (48 x 30 x 20 in) with a top entry. A second style of pot used in this fishery is conical in shape, 1.3 m (4 ft) in diameter, and 0.45 m (22 in) high with a top-entry funnel. According to information provided in the 2002 red crab FMP (NEFMC 2002), vessels use an average of 560 pots that are deployed in trawls of 75-180 pots per trawl along the continental slope at depths of 400-800 m (1300-2600 ft). The pots are transported to and from

the fishing grounds during each trip and are generally hauled daily. The vessels are large, typically measuring 27-46 m (90-150 ft) long. There are six vessels engaged in this fishery, which is managed by the NEFMC.

## Whelk Pots

Wood and wire pots are used in southern Massachusetts waters to catch whelks, primarily the channeled whelk (pers. comm.; Frank Germano, Massachusetts Division of Marine Fisheries, New Bedford, MA). The pots are fished singly or in trawls with as many as 40 pots to a trawl in depths of 1.5-27 m (5-90 ft). They are set mostly on sandy bottom, often in or near seagrass beds. They are open at the top and baited, mostly with horseshoe crabs. Whelk pots are also used in coastal waters off New Jersey, Delaware, Maryland, and Virginia.

This activity is not managed under federal FMPs.

## Trap Nets

A trap net is generally a largescale device that uses the seabed and sea surface as boundaries for the vertical dimension. The gear is installed at a fixed location for a season, and is passive, as the animals voluntarily enter the gear. Trap nets are used in nearshore areas through which fish regularly move or congregate. They are of varying size and configuration and rely for their effectiveness on preventing fish from leaving the trap once they have entered it. They are made of a leader or fence that directs fish into the trap, and a heart, or parlor, that leads fish via a funnel into the bay or trap section where the fish are held until they are harvested by the fishermen. Four specific types of trap net are described in this document.

## Fish Pound Nets

Pound nets are constructed of netting that is attached to piles or stakes driven into the seafloor. Pound nets have three sections: the leader, the heart, and the pound. The leader (there may be more than one) may be as long as 400 m (1300 ft), and is used to direct fish into the heart(s) of the net. One or more hearts are used to further funnel fish into the pound and prevent escapement. The pound, which may be as large as a 15-m (49-ft) square, holds the fish until the net is emptied. The pocket usually has a netting floor; the fish are concentrated for "brailing" (a "brailer" is a very large dip net) by gradually bringing the sidewalls and bottom netting into boats working inside the pocket. These nets are generally fished in waters <50 m (160 ft) deep. A number of federally managed species are harvested in pound nets (Table 3.1).

This activity is not managed under a federal FMP.

## **Fyke Nets**

Constructed of a series of wood or metal hoops covered with netting, fyke nets are 2.5-5.0 m (8.2-16.4 ft) long. There are usually two wings of netting at the entrance which are attached to upright stakes and give the overall net a “Y-shape.” (Fyke nets that don’t have wings are also called hoop nets). There are one or more funnels inside the net that direct fish to the rear of the net (the “car”) where they become trapped. Occasionally, a long leader is used to direct fish to the entrance. Fish are removed by lifting the car out of the water and loosening a rope securing the rear of the car. These nets are generally fished in shallow water and used in river fisheries.

Fyke net fishing activity is not managed under a federal FMP.

## **Weirs**

A weir is a simple maze that intercepts species that migrate along the shoreline. Weirs are used in the juvenile Atlantic herring fishery in eastern Maine and New Brunswick (Bay of Fundy) where the tides are extreme. At low tide, closely spaced wooden stakes are driven into the bottom. In the traditional style of weir, brush is interwoven between the stakes to form a barrier. Traps formed of netting have largely replaced the wooden weirs. The fish encounter the lead that they follow to deeper water, finally passing into an enclosure or “pound.” Once they are concentrated in the “pocket,” the fish are removed with a small purse seine. There are very few weirs currently in use in Maine (ASMFC 1999a).

This activity is not managed under a federal FMP.

## **Floating Traps**

In New England, much of the shoreline and shallow subtidal environment is rocky, and stakes cannot be driven into the bottom. Therefore, a floating trap can be designed to fish from top to bottom, and be built to suit the individual location. The webbing of such traps is supported at the sea surface with floats, and held in place on the seafloor with large anchors. The net is usually somewhat “T-shaped,” with the long portion of the net (*i.e.*, the leader) designed to direct fish into a box of net at the top of the T. The leader is often made fast to a ring bolt ashore. The catch, design elements, and scale of these floating traps are similar to pound nets.

This activity is not managed under a federal FMP.

## **Bottom Gill Nets**

A gill net is a large wall of netting which may be set at or below the surface, on the seafloor, or at any depth between. They are equipped with floats at the top and lead weights along the bottom. Bottom gill nets are anchored or staked in position. Fish are caught as they try to pass through the net meshes. Gill nets are highly selective because the species and sizes of fish caught are highly dependant on the mesh size of the net. They are used to catch a wide range of species, including many federally managed species (Table 3.1).

## **Sink/Anchor Gill Nets**

Gill nets have three components: leadline, netting, and floatline. Leadlines used in New England are 30 kg (65 lb) per net; leadlines used in the Mid-Atlantic are slightly heavier. The netting is monofilament nylon, and the mesh size varies depending on the target species. Nets are anchored at each end, using materials such as pieces of railroad track, sash weights, or Danforth anchors. Anchors and leadlines have the most contact with the bottom. Individual gill nets are typically 91 m (300 feet) long and 3.6 m (12 ft) high. Strings of nets may be set out in straight lines, often across the current, or in various other configurations (*e.g.*, circles), depending upon bottom and current conditions. Bottom gillnet fishing occurs in the Northeast Region in nearshore coastal and estuarine waters as well as offshore on the continental shelf.

In New England, bottom gill nets are fished in strings of 5-20 nets attached end to end. They are fished in two different ways, as “standup” and “tiedown” nets (Williamson 1998). Standup nets are used to catch Atlantic cod, haddock, pollock, and hake and are soaked for 12-24 hr. Tiedown nets are set with the floatline tied to the leadline at 1.8-m (6-ft) intervals, so that the floatline is close to the bottom, and the net forms a limp bag between each tie. They are left in the water for 3-4 days, and are used to catch flounders and goosefish (monkfish). Bottom gill nets in New England are set in relation to changes in bottom topography or bottom type where fish are expected to congregate. Other species caught in bottom gill nets in New England are spiny dogfish, and skates (Table 3.1).

In the Mid-Atlantic, sink gill nets are fished singly or in strings of just 3-4 nets (*pers. comm.*; Glenn Salvador, National Marine Fisheries Service, Lewes, DE). The Mid-Atlantic fishery is more of a “strike” type fishery in which nets are set on schools of fish or around distinct bottom features and retrieved the same day, sometimes more than once. They catch species such as bluefish, Atlantic

croaker, striped bass, spot, mullet, spiny and smooth dogfish and skates.

The use of sink gill nets in federal waters is managed under federal FMPs. The use of gill nets is restricted or prohibited in some state waters in the region.

### **Stake Gill Nets**

Generally, stake gill nets are used inshore. A small boat is used to set the net across a tidal flow, and to lift it at slack tide for removing fish. Wooden or metal stakes run from the surface of the water into the sediment and are placed every few meters along the net to hold it in place. When the net is lifted, the stakes remain in place. Stake gill nets are used in the Mid-Atlantic states to catch red drum, bluefish, king mackerel, and Spanish mackerel (Table 3.1).

These activities are not managed under federal FMPs.

### **Run-Around Gill Nets**

The run-around gill net is used in shallow, nearshore areas to encircle schools of fish. They are set rapidly from the stern of small, fast boats. The headline contacts the bottom, thus preventing the fish from escaping. Run-around gill nets are used in the Northeast Region to catch red drum (Table 3.1).

Use of this type of gill net is not managed under federal FMPs.

### **Bottom Longlines**

A longline is a long length of line, often several miles long, to which short lengths of line ("gangions") carrying baited hooks are attached. Longlining for bottom species on continental shelf areas and offshore banks is undertaken for a wide range of species. The two primary federally managed species caught with this gear in 2004 in the Northeast Region were golden tilefish and redfish (Table 3.1). Bottom longlines are also referred to as "trot" lines and are used in the Mid-Atlantic states to harvest blue crabs.

Bottom longline fishing in the Northeast Region is conducted with hand-baited gear that is stored in tubs ("tub trawls") before the vessel goes fishing, and with vessels equipped with automated "snap-on" or "racking" systems. The gangions are 38 cm (15 in) long and 0.9-1.8 m (3-6 ft) apart. The mainline, hooks, and gangions all contact the bottom. In the Cape Cod (Massachusetts) longline fishery, up to six individual longlines are strung together, for a total length of about 460 m (1500 ft), and are deployed with 9-11 kg (20-24 lb) anchors. Each set consists of 600-1200 hooks. In tub trawls, the mainline is parachute cord;

stainless steel wire and monofilament nylon gangions are used in snap-on systems (Leach 1998). The gangions are snapped to the mainline as it pays off a drum, and removed and rebaited when the wire is hauled. In New England, longlines are usually set for only a few hours at a time in areas with attached benthic epifauna. Longlines used for tilefish are deployed in deep water, may be up to 40 km (25 mi) long, are stainless steel or galvanized wire, and are set in a zigzag fashion.

These activities are managed under federal FMPs.

## **PELAGIC GEAR**

### **Mid-Water Trawls**

Mid-water trawls are used to capture pelagic species throughout the water column. For nets used on single boats, the net is spread horizontally with two large metal doors positioned in front of the net. A common type of type of mid-water trawls used in the Atlantic herring and Atlantic mackerel fisheries is the "rope" trawl. The forward portion of these nets is constructed of a series of ropes that extend back to very large meshes in the forward portion of the net that become progressively smaller toward the rear of the net. In the second type of net, instead of ropes, the large meshes begin immediately in the forward portion of the net. The large opening of the net functions to "herd" schooling fish toward the rear of the net (see [www.gma.org](http://www.gma.org), the website of the Gulf of Maine Research Institute). Once the net is deployed, changes in its position in the water column (height above the bottom) are made by increasing or decreasing the speed of the vessel or by bringing in or letting out trawl wire (NOAA/NMFS 2005). An electronic sonar system mounted in the mouth of the net allows the fisherman to continually monitor the size of the net opening and the height of the net above the bottom during each tow. In most cases, two heavy weights (*e.g.*, "balls" of heavy chain each weighing 1000-5000 pounds) are attached forward of the net to cables that extend from the net opening to the trawl doors. This is done while fishing in deep water to get the net closer to the bottom without using as much trawl wire. Schools of fish are located by means of directional sonar systems. Mid-water trawls may occasionally contact the bottom if the target species remain near the bottom (NOAA/NMFS 2005).

Tows typically last for several hours and catches are large. The fish are usually removed from the net while it remains in the water alongside the vessel by means of a suction pump. In some cases, the fish are removed from the net by repeatedly lifting the cod end aboard the vessel until the entire catch is in the hold.

The use of mid-water trawls is managed under federal FMPs.

## Paired Mid-Water Trawls

Mid-water trawls that are towed by two vessels are called “pair” trawls. Pair trawls used in the Atlantic herring fishery are designed identically as single boat mid-water trawls, but do not have doors, since the net is spread by the two vessels. Pair trawls are also used to catch Atlantic mackerel (Table 3.1). The nets can be towed more efficiently by two vessels because of their combined towing power and because there are no doors. Pelagic pair trawling has proved particularly successful in catching fish schooling near the surface or in shallower areas where noise from the two vessels herds fish into the path of the net. Noise produced by a single vessel as it passes over a school of fish (especially herring, which are very sensitive to underwater sound) often causes fish to escape capture. Pelagic pair trawls may occasionally contact the bottom (NOAA/NMFS 2005).

Pelagic pair trawling is managed under federal FMPs.

## Purse Seines

The purse seine is a deep, nylon-mesh net with floats on the top and lead weights on the bottom. Rings are fastened at intervals to the headline, and a purseline runs completely around the net through the rings. A school of fish is encircled with the net, then the net is pursed by drawing in a cable that runs through all the rings until the fish are forced to the surface and into a small enough pocket in the net that they can be transferred to the vessel. Purse seines vary in size according to the species fished, the mesh size, the size of the vessel, and the depth to be fished. Purse seines are currently used in the Northeast Region to catch Atlantic herring, Atlantic menhaden, and several species of tuna.

In the herring fishery, one end of the net remains in the vessel and the other end is attached to a power skiff that is deployed from the stern of the vessel and remains in place while the vessel encircles a school of fish with the net. Most purse seines used in the New England herring fishery range from 30 to 50 m deep (NOAA/NMFS 2005). If the depth of the net exceeds the depth of the water where it is set, the headline can contact the bottom when the nets are first set out, before they are “pursed.” Purse seining is a year-round pursuit in the GOM, but is most active in the summer when herring are more abundant in coastal waters. It is done at night, when herring are feeding near the surface. This fishing technique is less successful when fish remain in deeper water and when they do not form “tight” schools. Herring fishermen rely on directional sonar systems to locate schools of fish.

In the menhaden fishery, small airplanes are used to locate schools of menhaden. When a school is located, two purse boats, each carrying half of the net, encircle the school and close the net. The mother ship then comes alongside and pumps the fish aboard. A few small vessels

have only one purse boat. The typical menhaden purse seine net ranges in length from 300 to 430 m (980 to 1410 ft), and is 20-27 m (66-89 ft) deep (ASMFC 1999b).

Use of herring and tuna purse seines is managed under federal FMPs, but the menhaden fishery is managed by the ASMFC.

## Drift Gill Nets

Drift gill nets are designed to float from the sea surface and extend downward into the water column, and are used to catch pelagic fish. In this case, the buoyancy of the floatline exceeds the weight of the headline. Drift gill nets may be anchored at one end or set out to drift, usually with the fishing vessel attached at one end. This gear does not come in contact with the bottom.

The use of drift gill nets is managed under federal FMPs.

## Pelagic Longline Gear

Pelagic or subsurface longlining is a technique used mostly in the open ocean to catch highly migratory species of tuna, swordfish, and sharks. The gear is typically set at depths from the surface to around 330 m (1080 ft). It can also be set with a mainline hanging in arcs below buoy droplines to fish a series of depths. The length of the mainline can be up to 108 km (67 mi), depending on the size of the vessel. If the mainline is set at a fixed depth, then the leader (*i.e.*, gangion) lengths vary from 2 to 40 m (7 to 131 ft), thus ensuring that the hooks are distributed over a range of depths. If a line-shooter is used to set the mainline in a catenary shape, then the gangions are usually a single minimal length, thus again ensuring that the hooks are distributed over a range of depths. Each gangion typically contains a baited hook and chemical night stick to attract the fish. Traditional or circle hooks may be used. Swordfish vessels typically fish 20-30 hooks per 1.6 km (1 mi) of mainline, which is between 5 and 54 km (3 and 34 mi) long. This gear does not contact the bottom.

The use of pelagic longlines to catch highly migratory species is regulated by the National Marine Fisheries Service (NMFS).

## Troll Lines

Trolling involves the use of a baited hook or lure maintained at a desired speed and depth in the water. Usually, 2-4 or even more lines are spread to varying widths by the use of outrigger poles connected to the deck by hinged plates. Line retrieval is often accomplished by means of a mechanized spool. Each line is weighted to reach the desired depth and may have any number of leaders attached, each with a hook and bait or an

appropriate lure. Troll lines are used to catch a variety of pelagic species in the region, including king mackerel (Table 3.1). This gear does not contact bottom habitats.

This activity is managed under federal FMPs.

## OTHER GEAR

### Rakes

A bull rake is manually operated to harvest northern quahogs (*Mercenaria mercenaria*), or hard clams, and consists of a long shaft with a rake and basket attached. The length of the shaft can vary, but usually does not exceed three times the water depth. The length and spacing of the teeth, as well as the openings of the basket, are regulated to protect juvenile clams from harvest. Rakes are typically fished off the side of a small boat. They are used in estuarine waters throughout the region.

This activity is not managed under federal FMPs.

### Tongs

Tongs are used to harvest shellfish in shallow water. There are two principal types: shaft tongs and patent tongs. Manually operated shellfish tongs are used in nearshore and estuarine waters throughout the region, primarily to harvest hard clams and eastern oysters.

Shaft tongs are a scissorlike device with a rake and basket at the end of each shaft. The fisherman stands on the edge of the boat and progressively opens and closes the baskets on the bottom, gathering the shellfish into a mound. The tongs are closed a final time, brought to the surface, and the catch emptied on the culling board for sorting. The length of the shaft must be adjusted for water depth. Oysters are traditionally harvested with shaft tongs in water depths up to 6 m (20 ft), with the shaft tongs themselves being 8 m (26 ft) long.

Patent tongs are also used to harvest hard clams and oysters. They are opened and closed with a drop latch or with a hydraulic ram, and require a mechanized vessel with a mast or boom and a winch.

This activity is not managed under federal FMPs. Patent tongs are regulated by state fisheries agencies according to weight, length of teeth, and bar spacing in the basket.

### Line Fishing

#### Hand Lines/Rod and Reel

The simplest form of hook-and-line fishing is the hand line, which may literally be fished “by hand” or using a rod and reel. The gear consists of a line, sinker, leader, and at least one hook. The line is usually stored on a small spool

and rack and varies in length. The sinkers vary from stones to cast lead. The hooks vary from single to multiple arrangements in “umbrella” rigs. An attraction device must be incorporated into the hook, usually a natural bait or an artificial lure. Hand lines can be fished in such a manner as to hit bottom and bounce, or to be carried by currents until retrieved.

Hand lines and rods and reels are used in the Northeast Region to catch a variety of demersal and pelagic species (federally managed species are listed in Table 3.1), including species of tuna, sharks, billfish, and swordfish.

This activity is managed under federal FMPs.

#### Mechanized Line Fishing

Mechanized line-hauling systems have been developed to allow more lines to be worked by smaller crews, and to use electrical or hydraulic power to work the lines on the spools or jigging machines. These reels, often termed “bandits,” are mounted on the vessel bulwarks and have a spool around which the mainline is wound. Each line may have a number of branches and baited hooks, and the line is taken from the spool over a block at the end of a flexible arm. Hooks and sinkers can contact the bottom, depending upon how the gear is used.

Jigging machine lines are generally fished in waters up to 600 m (1970 ft) deep. Jigging refers to the action of jerking a line with several unbaited hooks up in the water to snag a fish in its body. Jigging is commonly used to catch squid.

This gear is used to catch a variety of demersal and pelagic species, including highly migratory species of tuna, sharks, and swordfish. The use of this gear is managed under federal FMPs.

#### Hand Hoes

Intertidal flats are harvested for baitworms (*Glycera dibranchiata* and *Nereis* spp.) and softshell clams by using handheld hoes. These hoes are short-handled, rakelike devices that are often modified gardening tools (Creaser *et al.* 1983). Baitworm hoes have 5-7 tines which are 21-22 cm (8.3-8.7 in) long when used for bloodworms, and which are 34-39 cm (13-15 in) long when used for sandworms. Clam hoes in Maine typically have 4-5 tines which are 15 cm (6 in) long (Wallace 1997).

This activity is not managed under federal FMPs.

### Diving

Divers, either free diving or using SCUBA, harvest a variety of benthic invertebrate species -- including sea urchins, scallops, and quahogs -- in relatively shallow coastal and inshore waters throughout the region. Often, a

support vessel is used to transport the diver(s) to the fishing site and carry the catch to shore. Divers often use small rakes or hoes to scrape animals off rocks or dig them out of the seafloor. Generally, the catch is placed in bags that are either towed to the surface by the boat or floated to the surface using an air source and a lift bag.

This activity is not managed under federal FMPs.

## **Spears and Harpoons**

Spears with long shafts (gigs) are used by fishermen in small boats to catch fish in shallow water, and by divers. Harpoons are used offshore to fish for certain highly migratory species.

The use of spears in state waters is not managed under federal FMPs, but the use of harpoons in the tuna fishery is managed by NMFS.

Table 3.1. Percentage of landings (1% or more by weight) by fishing gear type for federally managed species and species groups in the Northeast Region in 2004. (Does not include highly migratory species, *i.e.*, tuna, sharks, swordfish, and billfish.)

Gear	Species and Species Groups																			
	American Plaice	Atlantic Cod	Atlantic Halibut	Atlantic Herring	Atlantic Mackerel	Atlantic Surfclam	Barndoor Skate	Black Sea Bass	Bluefish	Butterfish	Clearnose Skate	Cobia	Goosefish	Haddock	Hake, Red & White	King Mackerel	Little Skate	Longfin Inshore Squid	Northern Shortfin Squid	
By hand Dip net Dredge, clam Clam dredge, hydraulic Dredge, other Dredge, sea scallop Dredge, surfclam + ocean quahog Gill net, drift Gill net, fixed or anchored, sink Gill net, other Gill net, run-round Gill net, set/stake Handline Haul seine, beach Haul seine, long Longline, bottom Longline, pelagic Pot/trap, lobster, inshore Pot/trap, lobster, offshore Pots + traps, crab, other Pots + traps, fish Pots + traps, other Pound net, fish Pound net, other Purse seine, herring Purse seine, other Rake, other Trawl, otter, bottom, fish Trawl, otter, bottom, scallop Trawl, otter, bottom, other Trawl, otter, midwater Trawl, midwater, paired Troll line, other Troll and handline, combined Unknown																				
						6.6														
						2.6				1.5			2.0				1.0	2.7	1.3	
													2.1							
						90.2														
									1.0											
					9.5			1.7	44.4	4.1	66.2	28.4	53.7	2.3	6.3					
														2.5	5.6					
										14.4		34.9					19.8			
		3.9						5.1	3.5			14.0			3.2	3.5	5.1			
													</							

Table 3.1. Percentage of landings (1% or more by weight) for federally managed species and species groups by fishing gear type in the Northeast Region in 2004. (Does not include highly migratory species, *i.e.*, tuna, sharks, swordfish, and billfish.)

Species and Species Groups	
Gear	
	Ocean Pout
	Ocean Quahog
	Offshore Hake, Unclassified
	Pollock
	Red Deepsea Crab
	Red Drum
	Red Hake
	Redfish
	Rosette Skate
	Scup
	Sea Scallop
	Silver Hake
	Skates
	Smooth Skate
	Spanish Mackerel
	Spiny Dogfish
	Squids, Unclassified
	Summer Flounder
	Thorny Skate
By hand	
Dip net	
Dredge, clam	
Clam dredge, hydraulic	
Dredge, other	
Dredge, sea scallop	
Dredge, surfclam + ocean quahog	
Gill net, drift	
Gill net, fixed or anchored, sink	
Gill net, other	
Gill net, run-around	
Gill net, set/stake	
Handline	
Haul seine, beach	
Haul seine, long	
Longline, bottom	
Longline, pelagic	
Pot/trap, lobster, inshore	
Pot/trap, lobster, offshore	
Pots + traps, crab, other	
Pots + traps, fish	
Pots + traps, other	
Pound net, fish	
Pound net, other	
Purse seine, herring	
Purse seine, other	
Rake, other	
Trawl, otter, bottom, fish	
Trawl, otter, bottom, scallop	
Trawl, otter, bottom, other	
Trawl, otter, midwater	
Trawl, midwater, paired	
Troll line, other	
Troll and handline, combined	
Unknown	

Table 3.1. Percentage of landings (1% or more by weight) for federally managed species and species groups by fishing gear type in the Northeast Region in 2004. (Does not include highly migratory species, i.e., tuna, sharks, swordfish, and billfish.)													
Gear	Species and Species Groups												
	Tilefish	White Hake	Windowpane	Winter Flounder	Winter Skate	Witch Flounder	Yellowtail	ALL SPECIES					
By hand								0.05					
Dip net			1.0					0.02					
Dredge, clam								0.56					
Clam dredge, hydraulic								0.18					
Dredge, other							1.6	5.78					
Dredge, sea scallop								3.03					
Dredge, surfclam + ocean quahog								12.82					
Gill net, drift								0.01					
Gill net, fixed or anchored, sink	6.5	24.2	1.5	4.6	9.7	1.2	2.8	5.87					
Gill net, other								0.21					
Gill net, run-around								0.00					
Gill net, set/stake								0.23					
Handline	3.6							0.35					
Haul seine, beach								0.00					
Haul seine, long								0.02					
Longline, bottom	60.9	1.4						0.36					
Longline, pelagic								0.00					
Pot/trap, lobster, inshore								0.01					
Pot/trap, lobster, offshore								0.03					
Pots + traps, crab, other								0.10					
Pots + traps, fish								0.04					
Pots + traps, other								0.61					
Pound net, fish							4.8	0.05					
Pound net, other			1.6	9.5				0.68					
Purse seine, herring								0.61					
Purse seine, other								2.25					
Rake, other								0.07					
Trawl, otter, bottom, fish	19.2	71.5	91.2	76.2	82.7	89.8	81.7	35.81					
Trawl, otter, bottom, scallop								0.19					
Trawl, otter, bottom, other								0.39					
Trawl, otter, midwater								14.29					
Trawl, midwater, paired								12.16					
Troll line, other								0.74					
Troll and handline, combined								0.01					
Unknown	9.4	2.3	3.9	6.6	6.9	7.1	8.1	2.41					

Table 3.2. Percentage of landings for all species (1% or more of state total landings by weight) by fishing gear type for states in the Northeast Region in 2004													
Gear	STATE												
	ME	NH	MA	RI	CT	NY	NJ	MD	DE	VA	NC	ALL	
By hand									4.6				
Diving gear, urchins	1.7												
Dredge, clam						11.1							
Dredge, clam, hydraulic					6.6								
Dredge, crab									9.5				
Dredge, other	4.1		5.5	2.3		4.9	5.0			2.7		3.6	
Dredge, oyster									1.8				
Dredge, sea scallop			3.7		11.2		1.8			1.1		1.5	
Dredge, surfclam + ocean quahog			6.6	2.7	6.5	5.5	33.0	14.7				6.5	
Dredge, sea urchin	1.1												
Dredge, whelk									10.4				
Gill net, fixed or anchored, sink	1.4	14.5	8.2	3.8	1.7	3.6	2.8	1.3		2.6	15.0		
Gill net, drift								1.5	5.3			4.1	
Gill net, set/stake									10.0				
Handline			1.0			1.2			1.4				
Longline, bottom						3.1							
Longline, pelagic											3.4		
Pot/trap, lobster, inshore	23.6			1.5	2.9							3.8	
Pot/trap, lobster, offshore	1.9		3.7										
Pots + traps, blue crab													
Pots + traps, eel							1.8	45.8	47.6	4.8	15.5	3.9	
Pots + traps, other	1.7	1.1	2.7	2.4					3.2				
Pots + traps, whelk									2.1			1.1	
Pound net, fish									1.1				
Pound net, other			1.1	1.5				10.1		2.8	16.8	1.3	
Purse seine, herring	1.9	1.0										4.0	
Purse seine, menhaden							6.8			73.7		25.2	
Purse seine, other	7.4	1.0								8.1			
Rakes, other				1.4		2.9			1.1				
Tongs and grabs, other						3.2							
Trawl, otter, bottom, fish	11.8	69.3	29.7	65.4	37.1	42.4	22.4	2.0		1.4		18.6	
Trawl, otter, bottom, other											28.4		
Trawl, otter, bottom, shrimp	1.0	1.5									3.6		
Trawl, otter, midwater	17.5	3.7	15.8	3.6			7.6					7.3	
Trawl, midwater, paired	4.1	5.9	16.6	6.7			12.2					6.2	
Troll line, other					2.9	1.0					1.7		
Trot line with bait								20.9					
Unknown	17.4		2.4	6.0	28.2	18.6	2.9					4.8	

Table 3.3. Fishing gears and techniques used in the Northeast Region, categorized by the waters in which they are used, by whether or not they contact the bottom, and by whether or not their use is regulated by federal FMPs. (Includes all gears that accounted for 1% or more of any state's total landings, and all gears that harvested any amount of any federally managed species, based upon 2004 landings data and an ASMFC report on gear impacts to submerged aquatic vegetation (Stephan *et al.* 2000).)

Gear	Water Type			Contacts Bottom	Federally Regulated
	Estuary or Bay	Coastal (0-3 mi)	Offshore (3-200 mi)		
By hand	X	X			X
Diving	X	X	X		
Dredge, clam	X	X	X	X	X
Dredge, crab	X	X		X	
Dredge, mussel	X	X		X	
Dredge, oyster	X			X	
Dredge, bay scallop	X			X	
Dredge, sea scallop		X	X	X	X
Dredge, sea urchin		X	X	X	
Dredge, whelk	X			X	
Floating trap	X	X		X	X
Fyke and hoop net, fish	X	X		X	
Gill Net, drift			X		X
Gill Net, run-around	X			X	
Gill Net, sink/anchor	X	X	X	X	X
Gill Net, stake	X	X	X	X	X
Handline	X	X	X		X
Haul seine, beach	X	X		X	
Haul seine, long	X	X		X	
Haul seine, long (Danish)		X	X	X	X
Hoe	X			X	
Longline, bottom		X	X	X	X
Longline, pelagic		X	X		X
Otter trawl, bottom, crab	X	X	X	X	
Otter trawl, bottom, fish	X	X	X	X	X
Otter trawl, bottom, scallop		X	X	X	X
Otter trawl, bottom, shrimp	X	X	X	X	X
Otter trawl, midwater		X	X		X
Pots and traps, crab, blue	X	X		X	
Pots and traps, crab, other	X	X	X	X	X
Pots and traps, eel	X	X		X	
Pots and traps, fish	X	X	X	X	X
Pots and traps, lobster, inshore	X	X		X	
Pots and traps, lobster, offshore			X	X	X
Pots and traps, whelk	X	X		X	
Pound nets, crab	X	X		X	
Pound nets, fish	X	X		X	
Purse seines, herring		X	X		X
Purse seines, menhaden		X	X		
Purse seines, tuna		X	X		X
Rakes	X			X	
Reel, electric or hydraulic		X	X		X
Rod and reel	X	X	X		X
Scottish seine		X	X	X	X
Scrapes	X			X	
Spears	X	X	X		
Stop seines	X			X	
Tongs and grabs, oyster	X			X	
Tongs, patent, clam, other	X			X	
Tongs, patent, oyster	X			X	
Trawl, midwater, paired		X	X		X
Troll line, other		X	X		X
Trot lines, with bait		X	X		X
Weirs	X			X	